

CLAIMS:

1. An apparatus for detecting dislodgement of a needle inserted into a patient comprising:

a sensor capable of detecting wetness due to blood; and

5 a sensor holder adapted to secure the sensor in juxtaposition to the needle such that the sensor detects wetness due to blood loss from the patient upon dislodgement of the needle.

10 2. The apparatus of Claim 1 wherein the sensor comprises a resistive sensor, a capacitive sensor or combination thereof.

15 3. The apparatus of Claim 2 wherein the resistive sensor comprises a loop configuration of conductive electrodes.

4. The apparatus of Claim 3 wherein the loop configuration includes at least two loops of conductive electrodes.

5. The apparatus of Claim 2 wherein the capacitive sensor includes one or more electrodes.

20 6. The apparatus of Claim 5 wherein the capacitive sensor is located within the sensor holder such that the sensor does not contact blood upon detection thereof.

7. The apparatus of Claim 1 wherein the sensor produces a signal upon detection of blood loss.

25 8. The apparatus of Claim 7 further comprising a control device adapted to receive the signal for monitoring and controlling blood loss due to the dislodgement of 30 the needle during hemodialysis.

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9. The apparatus of Claim 8 wherein the control device is attached to the patient.

5 10. The apparatus of Claim 1 wherein the needle comprises a venous needle.

11. An apparatus for detecting needle dislodgement during hemodialysis comprising:

10 a sensor holder having a cavity; and
a capacitive sensor comprising an electrode enclosed within the cavity of the sensor holder such that the capacitive sensor is capable of detecting wetness from blood due to needle dislodgement during hemodialysis wherein the capacitive sensor does not contact blood upon detection thereof.

15 12. The apparatus of claim 11 wherein the electrode comprises a single plate electrode.

13. The apparatus of claim 11 wherein the capacitive sensor detects
20 wetness due to blood loss into a sterile pad overlying a vascular access region of a venous needle.

14. The apparatus of claim 13 wherein the sensor holder comprises a flexible material that adaptedly conforms to the vascular access region such that the
25 capacitive sensor is capable of detecting blood loss due to needle dislodgement.

15. An apparatus for detecting dislodgement of a needle inserted into a patient during hemodialysis comprising:

30 a resistive sensor capable of detecting wetness due to blood wherein the resistive sensor comprises at least two electrodes; and

a sensor holder defining an interior for receiving at least a portion of the needle and coupling the resistive sensor to the patient such that the resistive sensor is capable of detecting blood loss due to dislodgement of the needle.

5 16. The apparatus of claim 15 wherein the electrodes each comprise a loop
configuration.

17. An apparatus for controlling blood loss from a patient during hemodialysis comprising:

10 a sensor capable of detecting wetness due to blood and a sensor holder
adapted to secure the sensor to the patient such that the sensor produces a signal
indicative of wetness due to blood loss from the patient upon dislodgement of a venous
needle inserted into the patient; and

a controller capable of processing the signal to prevent blood flow through the venous needle such that blood loss from the patient due to dislodgement of the venous needle is minimized.

18. The apparatus of Claim 17 wherein the sensor holder comprises a pad configuration overlying an access region of the venous needle.

20 19. The apparatus of Claim 17 further comprising a sterile pad overlying an access region of the venous needle such that the sensor detects wetness in the sterile pad due to blood loss from the patient upon venous needle dislodgement.

25 20. The apparatus of Claim 19 wherein the sensor contacts the sterile pad to
detect wetness therein.

21. The apparatus of Claim 19 wherein the sensor is located inside of the
sensor holder such that the sensor does not contact the sterile pad upon detecting
30 wetness therein.

22. The apparatus of Claim 19 wherein the sensor comprises a resistive sensor, a capacitive sensor or combination thereof.

5 23. The apparatus of Claim 17 wherein the controller is in communication with a hemodialysis machine via an electrical communication cable or a cordless interface to minimize blood loss due to venous needle dislodgement.

10 24. The apparatus of Claim 23 wherein the controller is adapted to monitor one or more hemodialysis treatment parameters including wetness due to blood loss, change in blood flow and detection of arterial air bubbles during hemodialysis.

15 25. The apparatus of Claim 24 wherein the controller is attached to the patient for electrical connection to the sensor.

26. The apparatus of Claim 24 wherein the controller comprises a display for monitoring each of the parameters.

20 27. A method of detecting needle dislodgement comprising the steps of:
providing a sensor capable of detecting wetness due to blood;
inserting a needle into a patient; and
securing the sensor to the patient such that the sensor detects blood on the patient upon dislodgement of the needle.

25 28. The method of Claim 27 wherein the sensor comprises a resistive sensor, a capacitive sensor or combinations thereof.

29. The method of Claim 27 wherein the needle comprises a venous needle inserted into the patient for hemodialysis.

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30. A method of controlling blood loss from a patient due to needle dislodgement comprising the steps of:

providing a sensor capable of detecting wetness due to blood;

inserting a needle into the patient;

5 securing the sensor to the patient such that the sensor produces a signal indicative of wetness due to blood loss from the patient upon dislodgement of the needle; and

10 processing the signal to prevent blood flow through the venous needle such that blood loss from the patient due to needle dislodgement is minimized.

15 31. The method of Claim 30 wherein the sensor comprises a resistive sensor, a capacitive sensor or combinations thereof.

15 32. The method of Claim 30 wherein the needle comprises a venous needle inserted into the patient for hemodialysis.

20 33. The method of Claim 32 wherein the signal is processed for communicating with a hemodialysis machine to minimize blood loss to the patient due to needle dislodgement.

34. The method of Claim 33 wherein the signal is processed to shut-off a blood pump of the hemodialysis machine.

25 35. The method of Claim 33 wherein the signal is processed to activate a venous line clamp for preventing blood flow via the venous needle.

* 36. A method of providing dialysis to a patient comprising the steps of:
providing a sensor capable of detecting wetness due to blood;
inserting a venous needle into the patient;
securing the sensor in juxtaposition to the venous needle;

passing blood through the venous needle via a hemodialysis machine; and
detecting blood loss from the patient upon dislodgement of the venous needle.

37. The method of Claim 38 wherein blood flow through the venous needle
5 is stopped upon detecting dislodgement of the venous needle such that blood loss from
the patient is minimized.

38. The method of Claim 38 wherein the sensor comprises a capacitive
sensor that does not contact blood upon detection thereof.

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